MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

EEL 3146 – ELECTRIC POWER UTILIZATION AND INSTALLATION

(LE)

07 MARCH 2018
2:30 PM – 4:30 PM
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 7 pages including cover page with 5 Questions only.
2. Answer ALL questions. All questions carry equal marks and the distributions of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question 1

a) Explain the four roles of Energy Commission in Malaysia.

[6 marks]

b) Figure Q1 shows the single line diagram for a Single Phase Consumer Wiring. Explain the rationale to install three separate RCDs.

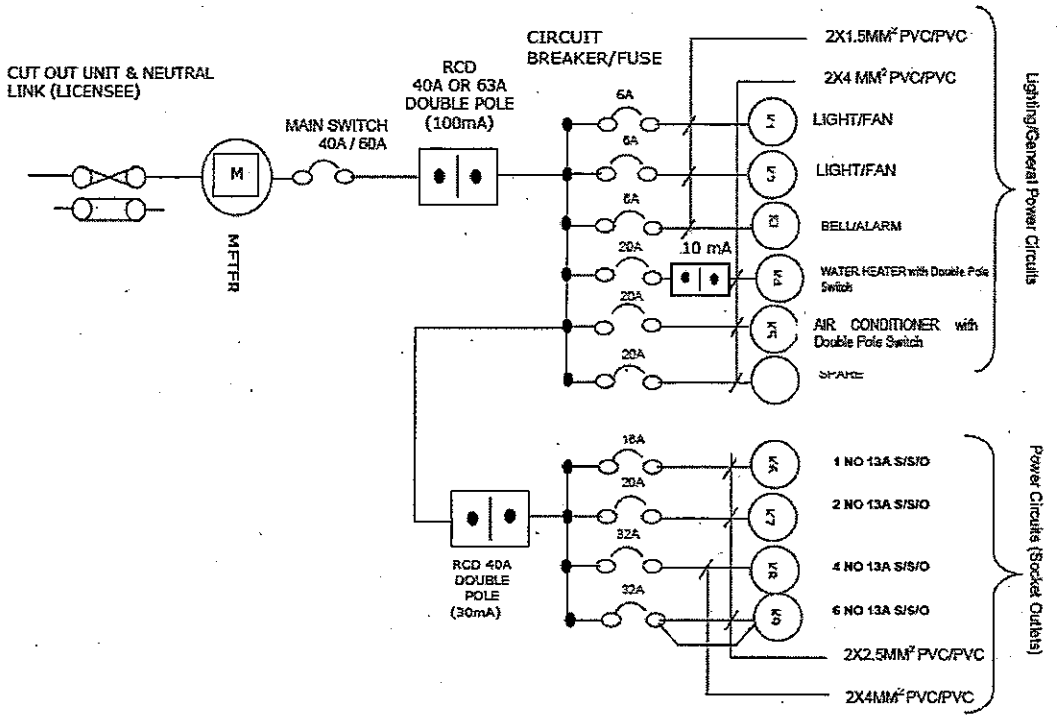

Figure Q1

[8 marks]

c) Sketch a circuit diagram for wiring installation for two lightings control by single switch.

[6 marks]

Continued...

Question 2

a) Sketch a typical speed-time curve for sub-urban train system. Classify and discuss regions of operation.

[9 Marks]

b) A train uses third rail system. The operation details are given below. Calculate the schedule speed of the train if distance of two stations is 3 km.

Acceleration: 1.7 km/hr/sec
Retardation: 1.3 km/hr/sec
Station stop time: 30 second
Maximum Speed: 65 km/hr

[11 Marks]

Question 3

Calculate the suitable size for the circuit protective conductor. (Use Figure Q3 and Table 1). Cross check your answer with the adiabatic equation, given k =115.

The circuit is supplying a fixed equipment and it is protected with a 32A Miniature Circuit Breaker (MCB). The installation is done with 4 mm^2 single core PVC non-sheathed cables enclosed in PVC conduit. Given, the fault earth loop impedance of the supply is 0.5Ω and expected disconnection time is 5 s. The time/current characteristic of MCB is shown in Figure Q3.

[20 Marks]

Table 1 - Resistance per meter of copper conductors at 20°C for calculation of R1 + R2

Conductor cross-sectional area (mm²)	*Resistance per meter run (m ohms / m)*
1.0	18.1
1.5	12.10
2.5	7.41
4.0	4.61
6.0	3.08
10.0	1.83
16.0	1.15
25.0	0.727

Note that to allow for the increase in resistance with increased temperature under fault conditions the values of (Table 1) must be multiplied by 1.2 for p.v.c. insulated cables

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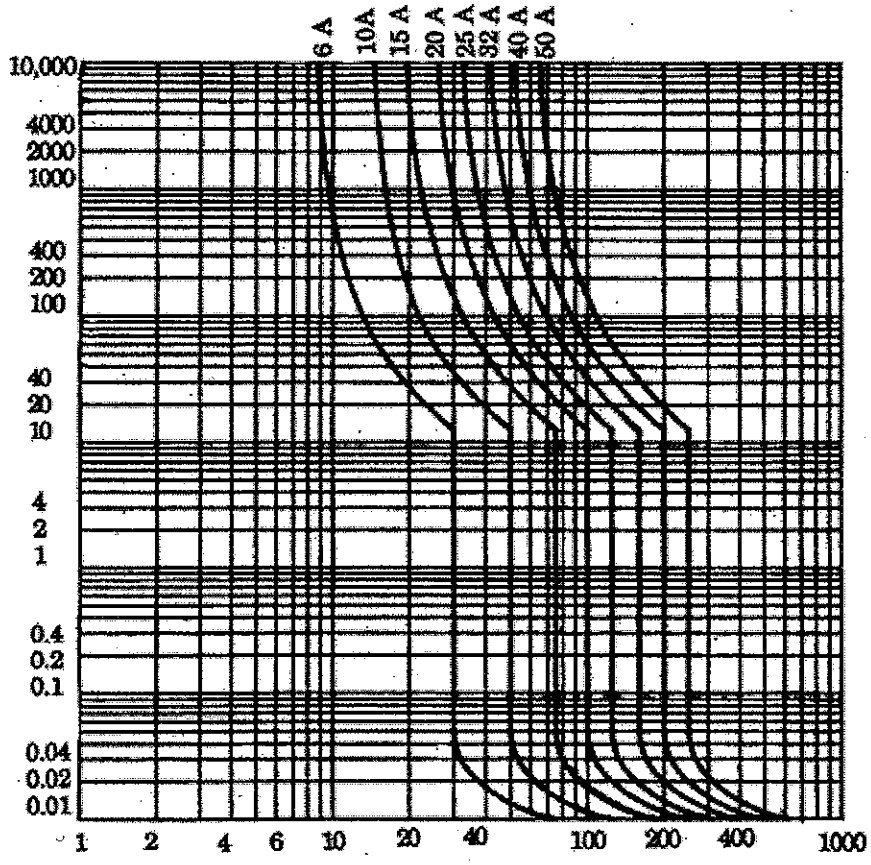

Figure Q3: Time/current characteristics of Type C MCB

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Question 4

A new office space to be used as a drawing office is to be illuminated. The dimension of the office is 12 m (length) x 10 m (width) x 3 m (height). Choices of LED downlights and their specification are given below.

LED-1
13W, 1000lm, 3000K

LED-2
100 lm/W, 16W, 3000K

a) Determine the minimum illuminance for this office space. Refer to table in Appendix A.
[4 Marks]

b) Determine the number of lamps required to obtain the minimum illuminance and highest efficacy. Assuming the maintenance factor is 0.8 and that coefficient of utilization is 0.6. The maximum lighting power intensity allowed is 14 W/m^2 and maximum colour temperature is 3500K.
[11 Marks]

c) List down two advantages and disadvantages of LED lamps.
[5 Marks]

Question 5

a) Discuss the methods used to control the temperature in a resistance furnace.
[7 Marks]

b) 15 tons of steel needs to be melted using a three-phase arc furnace in 3 hours time. The overall efficiency of the furnace is 70% and the current drawn from the supply is 8500A. The resistance and reactance of the furnace are 0.002Ω and 0.004Ω respectively. Assume that the ambient temperature is 25°C, specific heat of steel is 0.13 k Cal kg^{-1} $°C^{-1}$, Latent heat of steel is 9 k Cal/kg and the melting point of steel is 1371°C. Calculate the following: (Given 1 kW= 860 k Cal)

(i) The average input power (P_{in})
[6 Marks]

(ii) The arc voltage
[5 Marks]

(iii) The apparent input power (S_{in})
[2 Marks]

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Appendix A: MS 1525:2014

Table 10. Recommended average illuminance levels

Task and Applications	Illuminance (Lux)
a) Lighting for infrequently used area:	
- Minimum service illuminance	20
- Interior walkway and car-park	100
- Hotel bedroom	100
- Lift interior	100
- Corridor, passageways, stairs	100
- Escalator, travellator	150
- Entrance and exit	100
- Staff changing room, locker and cleaner room, cloak room, lavatories, stores.	100
- Entrance hall, lobbies, waiting room	100
- Inquiry desk	300
- Gate house	200
b) Lighting for working interiors	
- Infrequent reading and writing	200
- General offices, shops and stores, reading and writing	300 - 400
- Drawing office	300 - 400
- Restroom	150
- Restaurant, canteen, cafeteria	200
- Kitchen	150 - 300
- Lounge	150
- Bathroom	150
- Toilet	100
- Bedroom	100
- Class room, library	300 - 500
- Shop/supermarket/department store	200 - 750
- Museum and gallery	300
c) Localised lighting for exacting task	
- Proof reading	500
- Exacting drawing	1000
- Detailed and precise work	2000

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Examination Formula Sheet EEL3146

Lighting and Illumination

Inverse-square law

$$E = \frac{I}{d^2},\ E_x = \frac{I\cos^3\theta}{d^2}$$

Electric Traction

Trapezoidal Approximation

$$D = \frac{\left[2TV_m - V_m^2\left(\frac{1}{\alpha}+\frac{1}{\beta}\right)\right]}{7200}$$

Quadrilateral Approximation

$$D = \frac{\left[(V_1+V_2)T - V_1V_2\left(\frac{1}{\alpha}+\frac{1}{\beta}\right)\right]}{7200}$$

$$V_2 = \frac{V_1 - \beta_c\left(T - \frac{V_1}{\alpha}\right)}{1-\frac{\beta_c}{\beta}}$$

Net tractive effort for propulsion of train

$$F_t = 277.8M_e\alpha + Mr \pm 98MG$$

Total specific energy output

$$E_T = \frac{0.010726V_m^2}{D}\left(\frac{M_e}{M}\right) + 0.2778r\frac{D'}{D} \pm 27.25G\frac{D'}{D}\quad Whr/Ton\,km$$

Electric Heating

Heat transferred by radiation

$$Q = e\sigma A(\Delta T)^4$$

Where Q is the heat transferred by radiation, E is the emissivity of the system, σ is the constant of Stephan-Boltzmann (5.6697 x 10^-8 W/m^2.K^4), A is the area involved in the heat transfer by radiation, and $(\Delta T)^4$ is the difference of temperature between two systems to the fourth or higher power.

Earthing and Protection

Adiabatic equation

$$S = \frac{\sqrt{I_a^2 t}}{k}$$

End of paper